

SP-20
Log 1747

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 20, 1985

Forwarded to:

Honorable Donald D. Engen
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-85-7

On May 25, 1984, the No. 2 engine on an Air France Boeing 747, French Registry F-BPVS, sustained an explosive rupture of its compressor rear frame at Los Angeles International Airport, Los Angeles, California. The rupture occurred just after the flightcrew rotated the airplane for takeoff at 173 knots indicated airspeed. Simultaneous with the engine failure, the flightcrew observed a rapid drop in the No. 2 engine performance parameters and the illumination of the No. 2 engine thrust reverser "unlock and in transit" lights. The crew did not observe any "fire warning" or excessive engine nacelle temperatures. The crew discharged fire bottle "A". After the engine was shut down and fuel was dumped, the crew landed the airplane without further incident. (See attached brief of incident.)

Examination of the General Electric CF6-50 engine revealed that the left and right core cowl doors had separated explosively and the fan cowl doors and the thrust reversers had partially separated. The engine damage was confined primarily to the axially ruptured outer casing of the compressor rear frame (CRF). The frame was displaced radially outward from the forward to the aft circumferential flanges. The rupture proceeded through the No. 13 fuel nozzle mount pad, through the No. 13 combustion chamber mount pin hole, and continued to the lower ignitor mounting flange (boss). All of the compressor rear frame-to-turbine midframe attachment bolts were fractured. Additionally, the combustor outer liner and the combustor cowl were fragmented; most of the fragmented pieces were recovered.

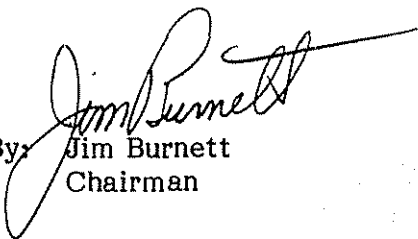
It was determined that the compressor rear frame had fractured as a result of a high-stress (low-cycle) fatigue. The fatigue originated at a zone of microporosity in the ignitor pad area of the compressor rear frame outer casing. The fatigue fracture was adjacent to the No. 13 fuel nozzle port, and it had propagated to a length of 6.2 inches. The remaining portion of the fracture was a rapid tensile overload failure.

This is the first General Electric CF6-50 engine CRF failure of this type on GE CF6-50 and -45 engines and at this location. The engine manufacturer has identified a population of about 606 CRF's which potentially are affected; these frames were manufactured during the 1979 and 1980 time period. During this period, the CRF casting vendor was experiencing shrinkage problems with the CRF casting which required that the affected casting be subjected to a weld repair. Subsequently, the vendor incorporated a number of process modifications and some pattern refinements, which ultimately alleviated the shrinkage problem. However, since a shrinkage condition also can be associated with microporosity, the CRF castings that were manufactured during this time period had a higher probability of manufacture with an inherent microporosity condition. To correct this condition in approximately 606 CRF's the engine manufacturer has issued Service Bulletin (S/B) 72-839, Revision No. 1, which recommends a repetitive on-wing inspection program with redundant inspection methods and which provides for the inspection and repair, or removal from service, of CRF's that are cracked, based on the extent of the cracking.

Although this failure is the first of its type, the consequences of this failure present a potential catastrophic hazard to the airplane; therefore, the Safety Board believes that mandatory action is appropriate. Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Issue an Airworthiness Directive to make mandatory the inspection, repair, and removal procedures recommended in General Electric Service Bulletin 72-839, Revision 1 (or later revisions if applicable), as to certain compressor rear frames of General Electric CF6-50 and -45 engines. (Class II, Priority Action) (A-85-7)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in this recommendation.


By: Jim Burnett
Chairman

R-E-L-E-A-S-E * * * * *
 P-U-B-L-I-C
 F-O-P
 N-O-T
 * * * * *
 ON CONTAINED IN THIS BRIEF OF ACCIDENT HAS NOT UNDERGONE ALL TECHNICAL REVIEWS AND/OR THE FINDINGS CONTAIN
 HEREIN HAVE NOT BEEN APPROVED BY THE DIRECTOR, BUREAU OF FIELD OPERATIONS**

NTSB # DCA84IA026
 File No. - 5052 5/12/84 LOS ANGELES, CA A/C Reg. No. FBPVS Time (Lcl) - 2156 PDT
 RUNDATE: 1 07 85

Brief of Incident
 Aircraft Damage
 MINOR
 Fire
 IN FLIGHT
 Fatal 0
 Serious 0
 Minor 0
 Injuries
 None 1
 0
 0

Basic Information
 Type Operating Certificate-COMMERCIAL OPERATOR
 Type of Operation -SCHEDULED/INTL/PAX/CARGO
 Flight Conducted Under -14 CFR 129
 Incident Occurred During -TAKEOFF
 Aircraft Information
 Make/Model - BOEING 747
 Landing Gear - TRICYCLE-RETRACTABLE
 Max Gross Wt - UNK/NR
 No. of Seats - 396
 Eng Make/Model - GE CF6-50
 Number Engines - 4
 Engine Type - TURBOFAN
 Rated Power - 47000 LBS THRUST
 ELT Installed/Activated - YES/NO
 Stall Warning System - YES

Environment/Operations Information
 Weather Data
 WX Briefing - UNK/NR
 Method - UNK/NR
 Completeness - UNK/NR
 Basic Weather - UNK/NR
 Wind Dir/Speed - UNK/NR
 Visibility - UNK/NR
 Lowest Sky/Clouds - UNK/NR
 Lowest Ceiling - UNK/NR
 Obstructions to Vision - UNK/NR
 Precipitation - UNK/NR
 Condition of Light - NIGHT(DARK)
 Itinerary
 Last Departure Point
 SAME AS ACC/INC
 Destination
 UNK/NR
 Airport Proximity
 ON AIRPORT
 Airport Data
 LOS ANGELES
 Runway Ident - UNK/NR
 Runway Lth/Wid - UNK/NR
 Runway Surface - UNK/NR
 Runway Status - UNK/NR
 ATC/Airspace
 Type of Flight Plan - IFR
 Type of Clearance - IFR
 Type Apch/Lndg - NONE

Personnel Information
 Pilot-In-Command
 Certificate(s)/Rating(s)
 ATP
 ME LAND
 Age - UNK/NR
 Biennial Flight Review
 Current - YES
 Months Since - UNK/NR
 Aircraft Type - UNK/NR
 Medical Certificate
 Flight Time (Hours)
 Total - UNK/NR
 Make/Model - UNK/NR
 Instrument - UNK/NR
 Multi-Eng - UNK/NR
 Last 24 Hrs - UNK/NR
 Last 30 Days - UNK/NR
 Last 90 Days - UNK/NR
 Rotorcraft - UNK/NR

Instrument Rating(s) - AIRPLANE
 Narrative
 DURING ROTATION THE #2 ENG SUSTAINED AN EXPLOSIVE RUPTURE OF ITS COMPRESSOR REAR FRAME(CRF). THE CREW OBSERVED A RAPID
 DROP IN THE #2 ENG PERFORMANCE PARAMETERS & THE ILLUMINATION OF THE #2 ENG THRUST REVERSERS "UNLOCK AND IN TRANSIT"
 LITES. THE CREW DISCHARGED A FIRE BOTTLE. AFTER THE ENG WAS SHUT DOWN & THE FUEL DUMPED, THE CREW LANDED THE ACFT
 WITHOUT FURTHER INCIDENT. THE ENG DAMAGE WAS PRIMARILY CONFINED TO AN AXIALLY RUPTURED OUTER CASING OF THE CRF. THE CRF
 HAD FRACTURED AS A RESULT OF A HIGH-STRESS(LOW-CYCLE) FATIGUE. THE FATIGUE ORIGINATED AT A ZONE OF MICROPOROSITY IN THE
 IGNITOR PAD AREA OF THE CRF OUTER CASING. TOTAL NUMBER OF CREW & PASSENGERS NOT REPORTED.

Brief of Incident (Continued)

File No. - 5052 5/12/84 LOS ANGELES, CA A/C Reg. No. FBVVS Time (Lcl) - 2156 PDT

Occurrence #1 EXPLOSION
Phase of Operation TAKEOFF - INITIAL CLIMB

- Finding(s)
1. COMPRESSOR ASSEMBLY, CASTING - FATIGUE
2. COMPRESSOR ASSEMBLY, CASTING - EXPLODED

Occurrence #2 LOSS OF POWER(PARTIAL) - MECH FAILURE/HALF
Phase of Operation TAKEOFF - INITIAL CLIMB

Occurrence #3 FORCED LANDING
Phase of Operation LANDING - FLARE/TOUCHDOWN

Finding(s)
3. FUEL DUMPED - INTENTIONAL - PILOT IN COMMAND

-----Probable Cause-----

The National Transportation Safety Board determines that the Probable Cause(s) of this incident is/are finding(s) 1